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The concept of resources and documents as means to understand mathematics teachers use of digital platforms in the classroom

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Abstract

Currently, digital learning platforms are being implemented in Danish elementary schools. These platforms are developed with a dual aim of both supporting teachers' planning and classroom teaching. This paper investigates and discusses the opportunities of using the documentational approach to study Danish mathematics teachers' use of these platforms for classroom teaching and preliminary findings here of in the context of an ongoing PhD project.

Keywords: Learning Management Systems, resources, documentational genesis

Introduction

The current amount of available digital resources such as e-textbooks and online teaching materials have made it a complex matter for mathematics teachers to choose, combine and redesign curriculum materials that meets the learning goals for at specific group of students (Abar & Barbosa, 2011). Digital resources for teaching are often found at various websites, and in different platforms, portals and fora, requiring teachers to navigate between many digital sites when planning a lesson (Nokelainen, 2006). In Europe, we currently see efforts from educational ministries, municipalities, school leaders and other stakeholders in education to reduce this complexity by purchasing and implementing digital learning platforms (DLP) (see for example KL, 2016; Johnson, Becker & Hall, 2015). The aspirations associated with DLP's is often that a single-portal-solution, where teachers can access all resources at one site, will make teachers' work easier (KL, 2016). Due an increase in 'bring your own device' policies, it has also become possible to use DLP's for classroom teaching (Johnson, Becker & Hall, 2015). The DLP's currently implemented in Denmark is characterized by exactly such a dual purpose in that they both are designed to support teachers' planning *and* classroom teaching (KL, 2016). The Danish DLP's has a student interface allowing teachers to use the platform to distribute lesson plans, tasks and activities to students in the classroom. This feature of is associated with hopes of freeing up teachers' time in the classroom (KL, 2016). DLP's allow students to manipulate on-screen objects, to log their academic progress and to make a range of mathematical inputs during the class. Such new available actions however often entail an increase in the complexity of real-time input for teachers to make sense of (Clark-Wilson & Noss, 2015). There is therefore good reasons to investigate *how* and *with what implications* teachers use DLP's in their teaching.

Studies of mathematics teachers use of DLP is certainly not new. Particularly the documentational approach (Gueudet & Trouche, 2009) have inspired research about mathematics teachers' individual and collective work with various kinds of platforms (Gueudet, Pepin, Sabra & Trouche, 2016). There however seems to be a tendency in many of these studies to focus on teachers' work

with platforms *outside* the classroom (Gueudet & Trouche, 2009; Gueudet, Pepin, Sabra & Trouche, 2015) or what Remillard (2005) refers to as the design arena. This aspect of mathematics teachers' work with DLP's is no doubt of high relevance. The current Danish DLP however also brings new conditions and opportunities for classroom teaching that are critical to understand. Similar studies have been done previously (for example Ruthven, 2012) but these have often focused on content-specific technologies. The Danish DLP is different in that the it is a general-purpose technology that, nonetheless, most likely have implications for *mathematics* education.

The purpose of this paper to initiate a discussion about the opportunities of using the documentational approach (Gueudet & Trouche, 2009) as a framework to study Danish mathematics teachers use of DLP for teaching and to provide preliminary findings of this. The paper address this purpose tentatively in the context of my ongoing PhD project by suggesting a research design based on the documentational approach. In the paper, I seek to give an address the following three questions:

- How can the concept of resources and documents (Gueudet & Trouche, 2009) help understand the opportunities in and implications of using a DLP for classroom teaching?
- Which research questions are we able to answer by building on this framework, and which methods are appropriate to use?
- What role does DLP's play in mathematics teachers' classroom teaching?

Theoretical approach: Documents and resources

The documentational approach (Gueudet & Trouche, 2009) is designed to study teachers' selection, design and appropriation of resources. It draws on inspiration from the instrumental approach (Guin, Ruthven & Trouche, 2005) and Adler's (2000) concept of resources (Gueudet & Trouche, 2009). Inspired by the instrumental approach, teachers work with resources in considered a dialectic process, where teachers' usages and knowledge and the resources mutually affect each other (Gueudet & Trouche, 2009). Based on Adler's (2000), resources are defined as "*a range of other human and material resources, as well as mathematical, cultural, and social resources*" (Adler, 2000, 210). A *document* is thus considered as the product of combined resources, usages and knowledge (Gueudet, Soury-Lavergne & Trouche, 2012)

The advantage of the documentational compared to other available frameworks (for example TPACK (Misra & Köhler, 2006) and instrumental orchestrations (Drijvers et. al., 2010) is that it allow us to think of teachers choices of using and not using DLP's in classroom teaching in various situations as resource and document 'management'; as efforts in creating or maintaining situations in which certain resources are available. It thus enable us to study how the DLP's enters teachers' resource systems and documents and whether/how, DLP's create new infrastructures for documentational work. The framework also enable us to understand why teachers often uses DLP's partly and differently depending on the specific situation. Finally, if offers a sympathetic way of considering the reasons teachers might have *not* to use the DLP in certain situations.

Towards a research question

Drawing on the documentational approach, the third research question in this paper can be refined as follows:

How, when and with whom do mathematics teachers use and DLP in classroom teaching? Which resources and combinations of resources are enabled and disabled as a consequence of the above, and how do mathematics teachers manage and appropriate these resources?

Methodology and data and preliminary findings

To answer the research question posed above, information about teachers use, partial use and non-use of DLP are needed. Information about teachers' reasons and thoughts of why they use the DLP of parts of it in particular ways and when and why they choose not to use it is also needed. To collect data about this, I am conduction classroom observations and individual interviews with 4 individual mathematics teachers in grade 5-7 (age 12-14). The observations intend to generate insight in the following: *When are the platform used, and who and what are involved in the use of the platform? What resources and combinations or resources are enabled from the above? Which and how are these resources appropriated and which documents are thereof?*

Currently, I have completed observations and interviews with two teachers and I will complete observations and interviews of two additional teachers during November/December 2017. During the fieldwork done so far, I have both conducted formal and informal interviews. The formal interviews aimed at gaining an insight in the teachers conceptions and experiences of using (or reasons of not using) the LP's in the classroom. Further, the interviews investigated what resources the teachers was sensitive towards, and how they would draw on such resources (in the form of student expressions, classroom atmosphere, materials or other) in their teaching. The interviews included questions such as: *What do you consider important or relevant information when you are teaching? Which factors or information can make you adjust your plan for the lesson? In what situations are such information provided, and is it related to or influenced by the DLP?*

As I am currently processing the data, I will only briefly introduce preliminary findings here and elaborated the finding in the oral presentation at the conference. The interviews of the four teachers showed diverse perspectives on using DLP's and its implications. A teacher uttered the perspective that DLP's reflects managers' need to *"control what the students are doing in the classroom"* and that a DLP have no positive impact for student learning. He felt that his relational contact with the students were compromised when using a DLP, as students work on computers made it difficult for him to engage in their work. His resource management consisted in balancing between living up to the requirement from the management of using the DLP and maintaining a good relation to the students. Another teacher emphasized that using a DLP contributes in "*including students in the lesson on a much higher level. I use it to distribute the content of the lesson"*. He also thought the DLP as a resource helping him managing teaching resources in a single digital site.

Conclusion

This paper have discussed the opportunities of using the documentational approach to study mathematics teachers' use of learning platforms for classroom teaching in the context of my

ongoing PhD project. By using this framework in empirical studies, the paper suggested that in this context, the documentational genesis allow us to study how teachers work with DLP's for classroom teaching as *resource management*. Thereby, we are able to understand the reasons why teachers in some cases choose to use parts of DLP's partly, and different parts in different situations. This can provide important insights into how technologies not only bring new resources, but also may other resources previously available, and how teachers navigate professionally under such conditions. The preliminary findings also suggest that the potentials of DLP's must be studied in the light on the individual teachers' beliefs and perceptions of good mathematics teaching.

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